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Making the most of being a European Green Capital City: a cross-curricular PGCE project in Bristol's secondary schools

● Jon James ● Kate Hawkey ● Celia Tidmarsh

The award of European Green Capital to Bristol for 2015 provided the impetus for a group of PGCE tutors to work collaboratively with their student teachers in developing a climate change project for local secondary schools. This article outlines the rationale for the work, raising questions about the nature and purposes of the curriculum relating to green issues, in keeping with the aims of initial teacher education. The project had clear benefits in exposing science student teachers to different subject perspectives and enabling interdisciplinary working, while the running of the project in schools revealed the challenges of teaching societal and controversial issues.

Introduction and background

It was announced in 2013 that Bristol was to receive the European Green Capital award in 2015, the first city in the UK to do so, for its proven track record with environmental efficiency and for being an innovator in terms of the green economy. The award has prompted many initiatives in the city, and the University of Bristol, as a strategic partner of Bristol Green Capital, has taken the opportunity to reflect on its own practices and establish targets in relation to sustainability, e.g. 'to ensure that all students have the opportunity to encounter

Education for Sustainable Development at the University' (University of Bristol, 2015). As teacher educators, we saw opportunities to develop our PGCE student teachers' own experience of sustainable development, in line with the target above, and to work with Bristol's secondary schools and their staff and students on issues of sustainability and the environment. PGCE Science tutors also work closely with University of Bristol's School of Chemistry. It has developed a number of projects and lecture demonstrations that it takes out to Bristol schools, particularly in the area of climate change, and has gained international recognition for its innovative work (Shallcross, 2011; Shallcross et al, 2012).

However, the teaching of climate change comes with its challenges, because it is both a scientific and political object. We were keen to look at both those dimensions: the science of climate change and the socio-political issues that confront teachers in the classroom. They are closely linked; science teaching can make important contributions to citizenship through raising levels of political literacy and increasing awareness of social responsibility (Wellington & Ireson, 2012), while socio-scientific contexts can be a helpful vehicle for teaching





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scientific concepts and developing understanding of the nature of science (Fleaver-Lovitt, 2014). It was felt therefore that there would be advantage in combining with colleagues from the PGCE programmes in geography and history to develop cross-curricular workshops on climate change, which could be taken to a number of Bristol's secondary schools.

The culture of primary schools is more attuned to working on themes, in cross-curricular ways, than many secondary schools (Kerry, 2015). Hence Bristol Green Capital started its education work in the primary sector producing, for example, guidance for primary school teachers (European Green Capital, 2015). Examples of good practice in secondary schools, however, are less widespread, with the subject specialist and exam-oriented curriculum of those schools adding to the challenge of developing more creative and innovative practice. Despite these difficulties, PGCE tutors at the University of Bristol were keen to build on the previous small-scale inter-disciplinary initiatives that they had run in schools. The overall aims of the project were, firstly, to teach climate change from three specialist subject perspectives, namely geography, science, and history. A second aim was

to draw these three different disciplinary perspectives together into a final plenary that invited school students to evaluate the evidence with which they had engaged and consider possible future action in relation to climate change.

In this article we describe the workshops designed by PGCE student teachers, which were taken into five Bristol schools for half-day workshops in June 2015, working with 250 Year 9 (age 14) students. While the science elements are likely to be of more interest to readers of this journal, attention is also given to the different aims and perspectives of the other subjects involved, namely geography and history, as well as an evaluation of the whole project.

Science aims

Recent curriculum changes in science at Key Stage 3 (age 11-14) and in the core content that must form the basis of new GCSE Science specifications (for first teaching in September 2016) could be argued to have reversed the 'humanising' of the science curriculum that occurred in the last significant revision in 2007. Out has gone the 'how science works' component, which considered the





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social practices of scientists and the way that scientists worked in the world, to be replaced by 'working scientifically', which adopts a more objective approach, focusing on the technical nature of scientific methods. The space for consideration of climate change and other socio-scientific issues appears to have been diminished, both by the nature of the explicit references to the topic and the values that the curriculum espouses (Ross, 2014).

One of the driving forces behind these changes to the curriculum is the concern over a lack of young people choosing science at higher education level and as a career, and the potential implications for our country's economic competitiveness.

However, science is worthy of study for its own sake, regardless of whether one is going to become a scientist, as it has a key role in helping young people make sense of the world and their place in it, at both a local and global level. This 'making sense' idea was therefore a key reason for involving science student teachers in a collaborative climate change project, developing young people's understanding of the science and the scientific community's position on climate change.

A key reading (Poortinga *et al*, 2011) given to the science student teachers highlighted the problematic nature of the discourse around climate change and that scientists often have difficulties in confronting the arguments of climate change sceptics and deniers. We hoped that this project would enable student teachers to hear a variety of young people's perceptions of climate change, and experience views and attitudes that might differ considerably from their own. An important objective was that student teachers were challenged to think about not only their scientific assumptions, but also their own social values and attitudes.

Geography aims

Debates about climate change are increasingly common in the public discourses of society and so it is essential that, in school, young people are given the space and tools to consider the information and arguments that they are hearing in these discourses. It is no surprise that the study of climate change features in the geography curriculum, as it incorporates many elements, such as weather and climate systems, that are generally recognised as 'geographical'. Climate change appears in the current version of the





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Key Stage 3 Geography National Curriculum as well as the compulsory core content for GCSE in 2016.

The geographers' aim for the workshop they planned to run in school focused on ensuring that school students understood the causes of, effects of and possible solutions to climate change in relation to different countries across the world. A second aim related to the interactions between the geography cohort and their history and science peers in their co-curricular planning of the school workshops. For the student teachers, the collaboration with their history and science colleagues gave them opportunities to develop aspects of their own knowledge, which varied depending on the nature of the degree that they had studied. In the preparation for the workshops, those who had followed a more science-focused course appreciated discussions of the historians' 'big history' approach, whilst those with a more human geography-focused degree learned more about the science of climate change. For the entire geography cohort, there was the challenge of bringing the scientific approach alongside the social perspective and an acknowledgement that 'facts' need to be considered in the context of society's values and attitudes.

History aims

Climate change is not included in the History National Curriculum or in any GCSE or A-level history syllabuses. As such, it might be seen as an unusual choice of subject in which to focus on climate change. On the other hand, a key tenet of the study of history is the '*unending dialogue between the past and the present*' (Carr, 1961, p.30). In other words, what is considered significant, and therefore prioritised for study, does change over time, at least in part due to the concerns of the present. The current concern with climate change in society at large ensures that the topic has relevance and 'resonance' (Counsell, 2005) for secondary school students. In academic discourses, discussions focus on the need for history education to contribute to conversations of contemporary significance drawing from a knowledge and understanding of the historical roots of such issues.

While the 2014 Key Stage 3 programme of study does not specifically mention climate change as a topic for study, there are potential opportunities for it to be included, for example, where it states that the curriculum should help students '*to gain historical perspective by placing their growing*





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knowledge into different contexts, understanding ... long-term timescales'; and that the curriculum should include 'the study of an aspect or theme in British history that consolidates and extends pupils' chronological knowledge from before 1066' (National Curriculum, 2014).

For the school students, the aim was to provide historical background knowledge to help them to understand the historical roots of climate change. This was also an aim for the student teachers, who, by and large, lacked this sort of historical knowledge; as a result, becoming more familiar and confident with this 'new' knowledge became an important part of the student teachers' preparation for the workshops.

Preparation for the workshops

We were keen to make best use of subject specialisms that existed within the secondary schools and amongst the PGCE student teachers with whom we were working. In preparing for the workshops, therefore, each subject group worked separately, with their subject tutors leading preparation work and directing the student teachers' reading. Each subject problematised

climate change as an issue, thus providing opportunities for each subject group to develop its own specialist subject knowledge and confidence in relation to climate change and to generate its own particular subject aims for the workshop. In the case of science, there was input from tutors in both the Schools of Education and Chemistry to address gaps in student teachers' knowledge in relation to the science underpinning climate change and the pedagogy of teaching socio-scientific issues.

This was followed by a second phase of preparation, when the student teachers met in groups working with student teachers from other subjects who they would be working with in the particular schools they would be visiting. In this way, the workshops were designed to include both a subject specialist focus as well as the idea of blending subject pedagogies.

As part of the preparation, the groups needed to give particular attention to a final plenary activity that pulled together the different elements and consolidated the learning from the whole workshop. The plenary was also designed to move students beyond awareness-raising of climate change to consideration of practical actions, aims that





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unsurprisingly prompted controversy amongst the PGCE student teachers. Firstly, we acknowledged that some of the school students with whom we would be working were likely to hold climate change denial or sceptical views and our limited input was unlikely to impact much on these. Secondly, even amongst those who accept the reality of climate change, there were likely to be difficult, but entirely legitimate, views suggesting that any response to climate change will be 'too little, too late' (e.g. Lovelock, 2008); the nature and current dominance of neo-liberalism ensures that tackling climate change is unlikely to be taken seriously at a policy level (Carter, 2015). While these somewhat depressing views are entirely legitimate and worthy of discussion amongst the PGCE student teachers, we had reservations about foregrounding these positions in schools. Not only did we have very limited time in schools during the workshops, we were also very conscious that the age of the students involved might have made tackling these more critical perspectives problematic in the time available. As a result, we took a decision to ensure that potentially more optimistic outcomes were presented. We were conscious that, in doing this, we did not present the full range of views on the issue.

Science objectives and outcomes

Objectives:

To enable school students to meaningfully evaluate scientific evidence that relates to climate change and make informed decisions about remediating its effects.

Outcomes:

To produce an argument as to whether climate change is influenced by human activity; and

To generate and evaluate remediation options for climate change.

Activities:

The students were split into small groups and circulated around 4 stations where they engaged with a range of data and graphical sources relating to climate change, examples of which are shown in Figure 1. A student teacher facilitated each station, helping students to interpret information and asking questions that prompted students to think about whether the evidence supported or did not support the idea that human activity is significantly exacerbating climate change. Through this small group work, key scientific ideas, e.g. relating to gases and radiation, were introduced and checked for understanding, along with ideas about





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correlation and causation. Students summarised important ideas and evidence on an A3 sheet and produced a final conclusion in which they personalised the 'human activity' by considering their personal impact on climate change, along with possible remediation strategies.

Variations of the Earth's surface temperature for:

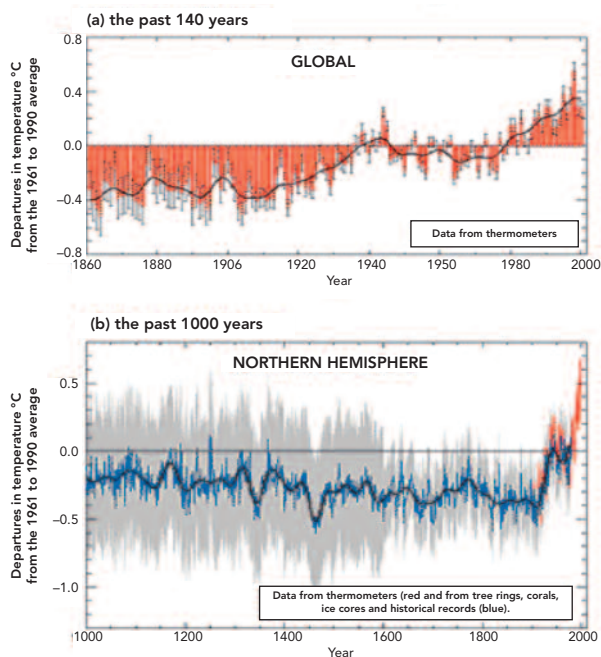


Figure 1: Example of graphs that were to be evaluated (Source: IPCC Third Assessment Report: Climate Change 2001. Summary for Policy Makers, P.3)

Geography objectives and outcomes

Objectives:

To categorise information about climate change in terms of causes/effects/solutions; and
To locate the information provided about different countries onto a world map and consider if any patterns emerge in relation to the nature of the categories identified.

Outcomes:

To produce a world map with the information of each country categorised and located correctly; and
To analyse emerging patterns re: causes/effects/solutions.

Activities:

Working in small groups, students were given 'fact cards' about a range of causes/ effects/solutions relating to different countries. They first had to decide to which category the information referred (i.e. cause/effect/solution). They then located the countries on the world map and stuck down the 'fact cards' in the correct locations. Finally, they looked for patterns and prepared a short paragraph summarising what they had found out to feed back to the whole group.



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History objectives and outcomes

Objectives:

To introduce students to a 'little big history' of climate change.

Outcomes:

To create a road map of climate change.

Activities:

Working in small groups, students were given a range of visual and textual sources and invited to create a chronological 'little big history' of climate change. The sources included a range of causes and consequences, e.g. the rise in the number of witch trials as a consequence of the Little Ice Age, in order to demonstrate the interaction between climate factors and human activity. Again working in small groups, students were asked to create a road map of climate change, and some examples are presented in Figure 2.

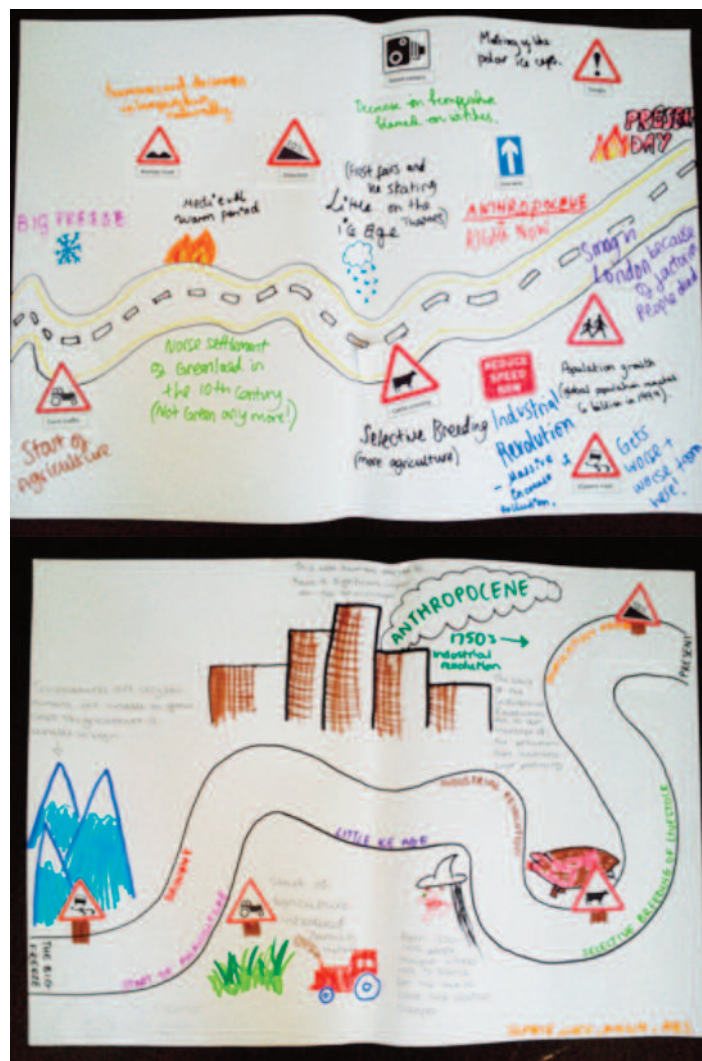


Figure 2: Two examples of road map student outcomes





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Final plenary action-focused objectives and outcomes

Objectives:

To introduce different responses to climate change and their impacts.

Outcomes:

To participate in an opinion line activity.

Activities:

Student teachers modelled different individual responses to climate change. For example, one student teacher presented an argument for getting involved with politics; another argued for campaigning to ban plastic bottles in school; another explained how they were going to reduce

their own personal carbon footprint. Students were then invited to create a human opinion line in response to the question, '*How responsible am I for climate change?*'. Students positioned themselves on one end of the line if they thought they were very responsible for climate change, at the other end if they thought they weren't at all responsible for climate change, or placed themselves anywhere along the line to reflect their opinion. The student teachers then led a discussion with the students.

In one school, an alternative activity was used in the plenary, though still with the same learning objective (see Figure 3).

What if...

... We painted everything white?
... Fossil fuels were not running out?
... We only used solar panels?
... We all worked less (three days a week)?

... We all walked and didn't use cars?
... We closed all factories?
... We all went vegetarian?
... There were only 1 billion people?

Colour code the type of response: Green = environmental; Red = social; Blue = economic

Figure 3: Example of a plenary activity used in one school





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Discussion

The views of the school students were elicited via a short written questionnaire while those of the student teachers were elicited through verbal feedback.

The comments from the students and student teachers confirm that the workshops included several valuable benefits. At the same time, they also became aware that changing behaviours is difficult and will not necessarily result from engaging learners in socio-scientific debate, confirming much research that suggests changing behaviours is difficult, slow and incremental (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007).

Some student comments included:

'It was a unique way of teaching'

'It was helpful because it showed three different perspectives of climate change'

'I still stand with my opinion that climate change is not crippling to us'

Student teacher comments included:

'Working with other subjects helped me to develop my skills and to see how subjects can connect'

'I developed my confidence running a workshop on a potentially controversial subject'

'It moved me beyond my "comfort zone"'

Student teachers of all subjects appreciated the different subject-specific strengths that were present, while also recognising the value of unified knowledge, and the need for these perspectives to connect with each other when teaching the workshops in schools.

Working with student teachers from other subject areas and also experiencing more informal learning environments enhanced science student teachers' repertoire of pedagogical approaches.

The experience also perhaps increased their awareness of the potential impacts of teaching; geography and history student teachers were concerned that engaging with the possible effects of climate change had the potential to worry and upset some school students and so ensuring wellbeing at the end of the workshop was made a priority.

It opened up societal and human action perspectives for them that might normally be associated with science teaching.





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Challenges and tensions

The challenges of the cross-curricular climate change workshops were different for each of the three subjects. For science, the teaching of the concepts underpinning climate change showed itself to be an ongoing challenge. In reality, the science is quite complex and, given the short time available for this project in school, the student teachers were left with the feeling that the students were dealing with the topic at a quite superficial level. The consensus view in the scientific community is that climate change has a significant anthropogenic dimension, hence many of the science student teachers were left uncomfortable in that students often did not draw that conclusion and saw little reason to take any form of personal action. However, this was one of the key objectives of this project, that student teachers experienced tensions with regard to their own attitudes and beliefs.

For history, the biggest challenge was one of securing subject knowledge in areas that have not traditionally been taught in the school history curriculum. This requires time and the identification of appropriate resources and this challenge is an ongoing one, since there are currently no school texts that focus on the history of climate change.

For geography, developing their own input was considered as relatively straightforward since many of the student teachers had already taught climate change. However, they would have welcomed more preparation time in their cross-curricular groups, as they didn't think sufficient time was allocated to develop the connections between their sessions. In some schools, student teachers were afforded the opportunity of visiting the history and science workshops. This was identified as a key benefit, since it facilitated a better understanding of different subject pedagogies, and supported a more effective connection between the different subject inputs.

Conclusion

There are important messages here for science teacher educators around the benefits of collaboration. Interdisciplinary working is not always something with which scientists feel comfortable, but the Green Capital status of Bristol provided a stimulus for science student teachers to work collaboratively with their peers in humanities subjects and with local schools. The support of the University's School of Chemistry also added expertise and reminded student teachers of the importance of conceptual understanding in enabling effective discussion of socio-scientific





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issues. Developing university-school partnerships through a project such as this can have a helpful influence on science education in the local area.

Working with different disciplinary perspectives also provided a rich stimulus for science student teachers to reflect on the nature of science, considering whether the subject's representation as a 'set of truths', using language that is often authoritarian and inhuman, helps in engaging young people with issues such as climate change. Although they felt a sense of responsibility for enabling school students to take action, they came to the realisation that those students often wanted to challenge the orthodoxy of science. The experiences of the project perhaps forced student teachers to reconceptualise climate change as something more unknowable, with its complexity meaning that science can only offer some of the solutions to the problem. As they considered more broadly the teaching of socio-scientific issues in their future careers, they were made aware that these issues are not solely scientific; understanding of other perspectives is required and that can be enriched by collaboration with different subject areas.

In some ways, of course, the project reinforced the view that climate change is treated as a peripheral

issue in schools and science student teachers felt that important social messages had not been conveyed. Nonetheless, through the project, the student teachers improved their preparedness and confidence to tackle this important topic within their own specialist subject area, whilst also benefiting from gaining an understanding of how other subjects approach the topic. Running an action-focused plenary gave all student teachers the experience of addressing an important societal issue and the opportunity to manage the range of attitudes and beliefs that school students brought to the task.

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